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## SUMMARY REPORT OF

# Utilization Research and Development

U.S. DEPARTMENT OF AGRICULTURE  
Agricultural Research Service  
Washington, D.C.  
May 1972



**SUMMARY REPORT OF**

**Utilization  
Research  
and  
Development**



## FOREWORD

This report is prepared in response to a request by the Committee on Appropriations in its report to the Senate on the Agricultural and Farm Credit Administration Appropriation Bill, 1960 (Report No. 330), for an annual summary statement on utilization research and development activities conducted by the Agricultural Research Service. Previous reports have been submitted for fiscal years 1959 through 1970.

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UNITED STATES DEPARTMENT OF AGRICULTURE  
Agricultural Research Service

SUMMARY REPORT OF UTILIZATION RESEARCH AND DEVELOPMENT

Fiscal Year 1971

I AIM AND OPERATION OF UTILIZATION RESEARCH

Utilization research, aimed at expansion of agricultural markets and reduction of processing and distribution costs, can increase farm income, benefit domestic consumers, and contribute to U.S. programs of assistance to developing countries. Such research can help to bring into balance the supply of, and demand for, farm commodities. In pursuing its objectives, USDA's utilization research and development effort is directed to: (a) devising new food products that are attractive and economical, and fit the distribution requirements in worldwide market channels; (b) improving functional properties of the natural fibers, cotton, wool, and mohair, to better meet consumer needs; (c) developing more economic and more suitable processed feed products needed in the expansion of the poultry, dairy, and livestock industries; and (d) seeking broadened and profitable industrial uses for agricultural materials. Concurrent attention is given to such related functions as expansion of foreign markets for U. S. agricultural products, improved nutritional quality of food products, protection of food products from contamination by toxins and other health hazards, and reduction of pollution caused by agricultural processing wastes.

The Department's utilization research investigations in fiscal year 1971 were conducted primarily in Federal facilities in the United States, consisting of five divisions or regional research laboratories (located in New Orleans, La.; Albany, Calif.; Wyndmoor, Pa.; Peoria, Ill.; and Athens, Ga.) and twelve subsidiary field locations (in Beltsville, Md.; Washington, D. C.; Waltham, Mass.; Lexington, Ky.; East Grand Forks, Minn.; Olustee and Winter Haven, Fla.; Raleigh, N. C.; Weslaco, Tex.; Pasadena, Calif.; Honolulu, Hawaii; and Puyallup, Wash.). Additional research outside of these laboratories and field locations is conducted through contracts, grants, and memoranda of understanding with State Experiment Stations, universities, private research institutions, and industry. Other supporting research is conducted in foreign research institutions through funds generated by the P. L. 480 program (Agricultural Trade Development and Assistance Act of 1954, 83rd Congress, 2nd Session, as amended). The regional research laboratories, with the subsidiary field locations, constitute five of the nine divisions of the Marketing and Nutrition Research group of the Agricultural Research Service.



## II MAKING UTILIZATION RESEARCH INFORMATION AVILABLE

Continuing, positive emphasis is placed on disseminating the results of utilization research to interested segments of the agricultural industry. The following summary illustrates the uses made of various information media in F.Y. 1971:

116	patents granted
970	technical papers published
708	speeches, press releases, and appearances on radio and television
38	formal conferences with industrial and other organizations
15	exhibits for the public and technical groups
6,474	technical visitors to regional laboratory installations

### (A) Exhibit Materials

The following special exhibits were prepared and shown during F.Y. 1971 to inform the public and technical groups of USDA developments in food, fiber, and industrial products made from agricultural sources:

Nature of Exhibit	Group Concerned
Unlocking food potential in cottonseed:	SOS/70, Third Internatl. Congress of Food Science and Technology, Washington, D.C.
Adequate food supply; clean environment; safe foods; Western Laboratory research facilities	
Explosion-puffed fruits and vegetables	
Poultry processing research	
Unlocking food potential in cottonseed	USDA patio, Washington, D.C.  Beltwide Cotton Production-Mechanical Conference, and Beltwide Cotton Research Conference Atlanta, Ga.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(A) Exhibit Materials (contd.)

Nature of Exhibit	Group Concerned
Wool research	: Fourth International Wool Textile : Research Conference, Berkeley, Calif.
Processed sheepskins	:
Chipping potatoes	: North Dakota State Potato Show and : Walsh County Fair
Whey products	: Food and Dairy Processing Exposition, : Houston, Tex.
New and improved uses for agricul- tural products	: White House
"Protein Around the World" (soybean food products)	: SOS/70, Third Internatl. Congress : of Food Science and Technology, : Washington, D.C.
New oilseed crops for the United States; waxy high-amylose corn	: Wisconsin Farm Progress Show : Sun Prairie, Wisc.
Kenaf as a new crop	: Lakeview Center for Arts and Sciences : Peoria, Ill.
Flame retardant cotton finish (batting and ticking)	: Texas State Fair : Dallas, Tex.
	: : : : : :

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations

Conference	Sponsors	Attend- ance	Location
1970 Conference on Citrus Chemistry and Utilization: (10/9/70)	USDA	126	Winter Haven, Fla.
1970 Technical Session on Cane Sugar Refining Research (10/12-13/70)	USDA and Cane Sugar Refining Research Project, Inc.	80	Boston, Mass.
20th Oilseed Processing Clinic (2/4-5/71)	USDA and Miss. Valley Oilseed Processors Assn.	110	New Orleans, La.
17th Annual Joint Conference of Cooperative Oil Mills (3/15-17/71)	USDA	194	Atlanta, Ga.
Conference of Collaborators from Southern Agricul- tural Experiment Stations (3/22-23/71)	USDA and Southern Agricultural Experiment Stations	59	New Orleans, La.
11th Cotton Utilization Research Conference (5/10-12/71)	USDA	161	New Orleans, La.
Lemon Products Technical Committee (3 times during year)	USDA	45	Pasadena, Calif.
20th Potato Utilization Conference (7/29-31/70)	USDA, Potato Growers Assn. of Calif. United Fresh & Vegetable Assn. and UC, Riverside	150	Riverside, Calif.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend- ance	Location
Dried Fruit Industry Research Advisory Committee (7/31/70)	USDA and Dried Fruit: Industry Research Committee	100	Fresno, Calif.
Dry Bean Research Conference (8/12-14/70)	USDA, Univ. of Calif: Davis, Nat. Dry Bean Industry and California Dry Bean Industry	60	Davis, Calif.
Research Committee of California Dry Bean Adv. Board (8/19/70)	USDA, and Research Committee of the California Dry Bean Adv. Board	15	Sacramento, Calif.
4th International Wool Textile Research Conf. (8/18-27/70)	USDA; Internatl. Wool Secretariat; Wool Growers and Processors of the U.S.; Univ. of Calif. (Berkeley); Textile Research Institute (Princeton)	400	Berkeley, Calif.
Research Conference on Marketing & Utiliz. of Western Oilseeds (11/5-6/70)	USDA, Univ. of Calif: and West Coast Oilseeds Development Council	72	Albany, Calif.
American Bakers Assn. Technical Liaison Comm. (11/18-20/70)	USDA, American Bakers Assn.	54	Oakland, Calif.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attendance	Location
Annual Citrus Research Conference (12/2/70)	USDA, and citrus industry	125	Pasadena, Calif.
League for International Food Information (LIFE) (1/14-15/71)	USDA and LIFE	33	Albany, Calif.
Date Industry Research Planning Conference (1/27/71)	USDA and Univ. of Calif.	21	Riverside, Calif.
Western Experiment Station Collaborators Conference: Disposal of Cellulosic Agricultural Residues (3/16-18/71)	USDA; EPA; Calif. Air Resources Board; Calif. Agriculture Expt. Station; Calif. Dept. of Agriculture	126	Albany, Calif.
Oilseed Crops Research Committee (5/20-21/71)	USDA and Univ. of Calif.	25	Fresno, Calif.
California Dry Bean Adv. Board Research Comm. (6/18/71)	USDA	15	Albany, Calif.
Ninth Milk Concentrates Meeting (9/14-15/70)	USDA, Penn State Univ.	70	Penn State, University Park, Pa.
Eastern Experiment Station Collaborators Conference (12/1-3/70)	USDA	100	Wyndmoor, Pa.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attendance	Location
Tobacco and Health Conference (3/22-26/71)	USDA, Univ. of Kentucky	25	Lexington, Ky.
Meat Packers and Processors seminar (4/13-14/71)	USDA, Pa. Meat Packers, Penn State Univ. and Rutgers Univ.	75	Camp Hill, Pa.
Cigar Manufacturers Assn. of America, Research Sub-committee meeting (4/15-16/71)	USDA	8	Wyndmoor, Pa.
NFPA LSO Technical Comm./ Technical Subcomm. II (6/14-15/71)	USDA, Natl. Flaxseed Processors Assn.	25	Peoria, Ill.
North Central Agr. Exp. Station Collaborators' symposium, "New High Protein Foods" (3/15-16/71)	USDA, North Central Agr. Exp. Station Collaborators	63	Peoria, Ill.
Soybean Utilization Research Conference (3/25/71)	USDA, Natl. Soybean Processors Assn.	22	Peoria, Ill.
Annual Corn Dry Milling Conf., Research Liaison Comm. of ACMF (6/3/71)	USDA, Amer. Corn Millers Federation	67	Peoria, Ill.



## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attendance	Location
Annual Corn and Wheat Utilization Conference (10/8/70)	USDA, and Scientific Comm., Corn Refiners Assn., Inc.	60	Peoria, Ill.
NCR-63 Mycotoxin Comm. (6/11/71)	USDA and North Central Agr. Exp. Station representatives	40	Peoria, Ill.
Industrial Utilization of Wheat and Wheat Products (6/16/71)	Nebraska Dept. of Agriculture	36	Lincoln, Neb.
Southern Sunflower Workshop	USDA Univ. of Ga. Natl. Cotton Products Assn.	55	Athens, Ga.
Coastal Bermudagrass Meeting	USDA, Coastal Bermudagrass Processors' Assn.	55	Athens, Ga.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

### (C) Rural Community Development Activities

During FY 1971, continued technical, economic, and management assistance was given to going and proposed agricultural processing enterprises in rural communities and other areas employing rural labor. Such assistance embraced a broad range of subject categories and involved groups ranging from the smallest to multi-million-dollar enterprises. In these efforts, appropriate liaison has been maintained with other Federal and State agencies concerned with rural community development.

Research contributions to the cotton industry, which provides millions of jobs on the farm and in rural communities, included advice and consultation, in-plant and mill trials, and laboratory and mill tests on a wide variety of textile operations. Specific activities involved processing and finishing of cotton goods; application of USDA-developed flame-retardant, durable-press, and weather-resistant finishes; development and use of product testing techniques; and fabrication and utilization of USDA-developed cotton processing machinery.

A few of the companies in the rural textile belt maintaining close contact with USDA scientists include the Art-Rich Manufacturing and West Point-Pepperell Companies, Dalton, Ga.; Eagle and Phoenix Mills and Sun Chemical Company, Columbus, Ga.; William Carter Co., Barnesville, Ga.; Garan, Inc., Starkville, Miss.; North Carolina Finishing Co., Salisbury, N. C.; Beacon Manufacturing Co., Swannanow, N. C.; Burlington Industries, Fieldcrest Mills and Cone Mills, Greensboro, N. C.; Glen Raven Mills, Glen Raven, N. C.; Spring Mills, Lancaster, S. C.; Crosrol Carding Development and John D. Hollingsworth on Wheels, Greenville, S. C.; and Brentex Cotton Mills, Brenham, Tex.

Additional examples of RCD activities in the cotton area are:

Advice on cleaning cotton textile mill waste to permit its use as raw material in manufacture of writing paper (Versatech Corp., Cooleemee, N. C.).

Advice on effect of different methods of harvesting cotton on textile processing efficiency and product quality, for use in guiding cultural practices (New Mexico State University Extension Service, Las Cruces, N. M.).

Advice and assistance to improve cotton textile processing efficiency through use of SMN research findings on fiber hooks and fiber orientation (Parkdale Mills, Gastonia, N. C.).



## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

### (C) Rural Community Development Activities (contd.)

Cooperation to develop improved cotton corduroy through application of polymer sizing developed in USDA research (Crompton-Shenandoah Co., Waynesboro).

Technical assistance and advice on equipment requirements and processing of USDA-developed flame-resistant cotton batting (Beal Bros., Catawba Cotton Felt Co., Cantwell Mattress Co., Kellwood Co.)

Rural community development activities extended to other commodity areas in addition to cotton. Examples are:

Demonstration of improved, accurate, rapid test for detection of aflatoxin in cottonseed and cottonseed meals. This test will benefit all oilseed mills in the rural South and Southwest (Western Cotton Products, Phoenix, Ariz.).

Studies on production of sugar from sweet sorghum to provide technical data to a new sugar growers' cooperative in the lower Rio Grande Valley. This new Valley industry benefitted from the positive feasibility inputs provided by USDA's studies of sorghum processing.

Technical assistance in dry caustic peeling of sweetpotatoes (Food Processors, Inc., and Tabor City Foods). The latter company has a grant from a Federal water pollution control agency for installation of equipment to utilize this process.

Development of a simple, low-cost method for removal of most of the dissolved organic material from waste water to reduce pollution problems for rural pine gum processing plants.

Continued assistance in adoption of the liquid cyclone process developed by USDA for production of food-grade protein concentrates and isolates, and in evaluation of these products for various food and feed end uses (Plain Cooperative Oil Mill, Lubbock, Texas).

Substantial increases in production of processed citrus products and employment of additional tens of thousands of farm laborers in the Southeast as a result of new and improved citrus products developed by USDA in cooperation with industry. Examples are canned, chilled, frozen concentrated, and foam-mat dried products.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Continued consultations with a grower and shipper of potatoes from Delano, Kern County, California, an area of high unemployment, concerning the establishment of a potato processing plant. Pilot runs were made testing the use of microwave in blanching to determine color retention in prepeeled potatoes.

Studies are being continued to find profitable uses for rice and wheat straws and hulls and other waste materials from farming, in order to reduce pollution caused by burning, dumping, and other presently used methods of disposal. These waste materials occur in rural areas, and any industry set up to process them will be beneficial in providing employment in those areas. Contacts are being maintained with grower and processor groups.

Continuing consultation on a project sponsored by the Four Corners Commission to construct a dry-bean processing plant in Southwest Colorado, a largely undeveloped area. Cooperated with the Economic Research Service in a market study of new products from dry pinto beans. Feasibility studies on the processing plant are now under consideration.

Consulted with the Apricot Producers Association on the problem of depressed markets and oversupply of apricots, advising them on improved storage and handling and demonstrating possible new products such as drum-dried puree, no-sulfur dried apricots, and Osmovac apricots.

Conducted research and consulted with agricultural producers and processors on growing and utilizing papayas for processing to use Hawaii acreage formerly devoted to sugarcane, but no longer needed for that crop.

Cooperated with the Washington State Experiment Station and farmers on production of wine grapes that might be well suited to newly available irrigated lands in the Columbia River Basin, and evaluated quality of wines from experimental vineyards.

Consulted with growers and processors on the oversupply and quality deficiencies which have depressed the Washington State mint industry. Initiated analyses on components responsible for lowered quality, in work aimed at restoring a competitive posture to this rural industry.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Assisted a grower-shipper in Delano, California, with analysis of processes and costs for constructing and operating a potato processing plant.

At the request of VITA, consulted on the commercial processing and marketing of a vegetable jelly food product, proposed as a business enterprise in a black community; the product may have market potential in rural areas.

Consulted with a California cooperative concerning new product ideas for marketing honey. Initiated exploratory work on the stability of honey-peanut butter mixtures.

In response to a request for assistance from a community action committee (OEO), initiated a study to seek redeeming quality in gorse, an ornamental hedge plant that has become a nuisance in the Pacific Northwest.

Participated in an ERS survey of consumers to ascertain present use of catfish and the factors that influence its use, as price, availability, appeal of name, etc., to evaluate the potential market for catfish and provide information to guide research programs for this new agricultural industry.

On-the-farm processing of tart cherries keeps processing wastes out of cities and towns and provides more employment in the orchards (Michigan). Aided by findings in on-site and central laboratory research, 8 compact cherry processing plants have been established in the rural orchard areas.

Tart cherries made available in new processed form for consumers (Michigan). Tart cherries, for the first time, are now being offered in a retail pack in sirup; this type of pack is available in canned and frozen forms for use as dessert or breakfast fruit.

New plant produces dried potato feed by dehydrating cull potatoes and trimmings from food processing operations (Presque Isle, Maine). Aided by engineering research findings, this plant was established for converting low-grade potatoes and food processing waste into a saleable feed product.



## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

### (C) Rural Community Development Activities (contd.)

Commercialization of deep-fat fried vegetable and fruit chips including sliced mushrooms, yams, parsnips, red beets and apples (West Chester, Pa.). These new gourmet snacks are being marketed nationwide and also are being exported to foreign countries.

New systems for mechanical harvesting of grapes (Paw Paw, Michigan area). Aided by cooperative research of USDA and the Michigan Experiment station 30 mechanical harvesters reaped 65% of the grape crop in Michigan, an increase of 230 tons over 1968.

Evaporation of the previously discarded expressed juice from pumpkin processing leads to a concentrate that can be added to the main product puree to increase the yield and eliminate a water pollution problem (Lancaster, Pa.).

Commercialization of a process for making a low-fat skimmilk cheese (Mayville, Wis.). A non-exclusive license was issued for use of the USDA patent, "Process of Making Low-Fat Ripened Skim Milk Cheese." Production trials have been made and actual marketing of the cheese is in prospect.

Development of rapid analytical methods for determining moisture and fat content in meat products (applicable by small meat processors nationwide in rural areas). A single laboratory extraction of samples of emulsion-type meat products, e.g. frankfurters and sausages, enables the small processor to control his operations so that regulations can be met.

P. J. Anderson and Company, Culbertson, Montana, was provided technical information on the processing and uses for mustard seed oil. This small rural company has an oil extraction plant at that location.

Illinois Cereal Mills, Inc., Paris, Illinois, was provided information on several new developments, including starch in rubber and cationic flour. Members of that company have visited USDA's Peoria laboratory on several occasions for additional information and assistance.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Vio-Bin Corporation, Monticello, Illinois, was provided information on processing of wheat germ and other cereal fractions.

Protein Plus Laboratories, Colfax, Illinois, was provided technical guidance and assistance on corn blight and its effects on corn. It was also provided information on the obtaining of L-Dopa from new crop seeds.

Normarc Company, Inc., Tangent, Oregon, was visited and was supplied information concerning the utilization of straws as a means of correcting environmental problems in the Northwest. The past practice of burning the straws must be discontinued for pollution control.

The Brown Boys, Inc., Fernwood, Pennsylvania, were assisted in their program to process and utilize corncobs. This is a small but important rural project.

Pacific Grain Company, Farmer City, Illinois, visited the USDA Peoria laboratory and also was visited by Department personnel regarding assistance on the processing and marketing of such existing crops as waxy corn and soybeans and potential new crops such as crambe.

Foremost Foods Company, Dublin, California, was provided technical information on the preparation of sugars from cereals.

McKee Baking Company, Collegedale, Tennessee, was provided information on the preparation of full-fat soy flours and CSM foods for possible manufacture and use in the southern regions.

Covert Farm, Ovid, New York, was provided information on the preparation of soybeans for human consumption. A new operation is under consideration.

Pierson Industries, Inc., Palmer, Massachusetts, was assisted in its program to produce polymers, including nylon 1313 obtained from the new crop, crambe.

Michelin Tire Corporation, Lake Success, New York, was provided information on the use of starch in rubber. This new development could provide major markets for agricultural raw materials.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

### (C) Rural Community Development Activities (contd.)

John B. Chandler Company, Atlantic Beach, Florida, was provided detailed information on the processing and use of soybeans and soybean products primarily for food products.

Dawson Mills, Dawson, Massachusetts, was provided technical and marketing information on the dry milling of corn.

Economic and processing information was provided many industrial companies, associations, and wheat commissions concerning the production and use of fermentation ethyl alcohol from cereal grains in motor fuels.

There presently exists a 43% excess crushing capacity among cottonseed oil mills in the South. This cottonseed processing equipment is located mainly in small towns throughout the region. If such equipment could be used to process other oilseeds (e.g., soybeans, sunflowers), additional jobs would be created and the economy of rural areas throughout the South improved. Technical guidance is being supplied to:

Louisville Fertilizer and Gin Company, Louisville, Ga.--  
Conducting investigations to identify optimum conditions (time, temperature, moisture) for processing full fat and low fat soybean meal for animal feed utilizing available cottonseed processing equipment.

Farmers and Ginners Cotton Oil Company, Birmingham, Ala.--  
Identifying optimum conditions for processing sunflower seed to achieve meal of optimum nutritive value for livestock (poultry and swine) feeding using cottonseed processing equipment.

Quitman, Georgia Chamber of Commerce--Locating new industry in Brooks County.

## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

Cooperative work with other groups is undertaken to develop new products, improve existing products and processes, devise economic processes for product manufacture, evaluate products and processes, and explore new outlets for agricultural products. These cooperative efforts contribute to early commercialization and broadened usage. Examples of cooperative research and development conducted in F.Y. 1971 are as follows:

Activity	Cooperators with USDA
Improved cotton fabrics for men's and boys' durable-press apparel	Cotton Inc.
Textile and clothing research	Univ. of Tennessee
Flame- and smolder-resistant cotton batting products	Cotton Inc., Natl. Cotton Batting Inst., Textile Fibers and Byproducts Assn., Natl. Cottonseed Products Assn.
Improved outdoor cotton fabrics	Canvas Products Assn. Internatl. Cotton Inc.,
Functional properties and chemical characteristics of cottonseed protein products	Cotton Inc., Natl. Cottonseed Products Assn.
Improved foam-mat dried citrus products	Florida Citrus Commission
Control of oxidative degradation of dehydrated foods	N. C. Agr. Exp. Station
Fermented cucumber and other vegetable products	Pickle Packers Internatl., Inc., North Carolina and Michigan Agr. Exp. Stations
Production of sugar from sweet sorghum	Texas Agr. Exp. Station, Louisiana State Univ.
Light-weight, low-cost agrifoams from agricultural products	Louisiana State Agr., Expt. Station



## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Wet processing of alfalfa	Dixon Dryer Co., Dixon, Calif.
Pollution control in the dehydration of forages	American Dehydrators Assn.
Processing of bagasse and pineapple and sugar cane field wastes for feed	University of Hawaii, Honolulu and Hilo
Processing rice straw for animal feed	Butte County (Calif.) Rice Growers Assn. and Univ. of Calif., Davis and Hopland
Dry caustic peeling of fruits to reduce pollution	Natl. Cannery Assn., Berkeley, Calif.
Plant-scale development of process for washable worsted sweaters	Columbiaknit, Inc., Portland, Ore.
Plant-scale demonstration of process for washable lamb's wool sweaters	Puritan Sportswear Corp., Altoona, Pa.
Plant-scale demonstration of process for machine washable, woven woolen fabrics	Pendleton Woolen Mills, Portland, Ore.
Preliminary trials of process for machine washable, piece dyeable woven fabrics	Carleton Woolen Mills, Rochdale, Mass.
Modified processing for sourdough bakery products	Colombo Bakeries, Oakland, Calif.; Larraburu Bros., San Francisco, Calif.; Safeway Stores, San Jose, Calif.
Lysine fortification of bulgur	Fisher Flouring Mills, Seattle, Wash.
Stabilization of flour blend A	Millers National Federation



## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd)

Activity	Cooperators with USDA
Specifications for, and improvement of, flour blend K	C. J. Patterson, Co., Kansas City, Mo., and Kansas State Univ., Manhattan, Kans.
Pollution reduction in wheat gluten processing	General Mills, Keokuk, Iowa
Market testing of frozen, quick-cooking beans	Oxnard Frozen Foods Coop. and China Doll, Inc.
Improved bean products	Lima Bean Advisory Board and Calif. Dry Bean Advisory Board
Commercial evaluation of IQB (individual quick blanch) process	Patterson Frozen Foods, Patterson, Calif.
Preservation of high-moisture dates	Calif. Date Administrative Comm.
Enzymic processing and vacuum hydration of dates	Cal-Date Co., Indio, Calif.
Control of microbiological contamination of dried fruits and nuts	Dried Fruit & Tree Nut Assn. of Calif.
Chemical manipulation of <u>Clostridium botulinum</u> spores	National Cannery Assn., Berkeley, Calif.
Processing of mechanically-harvested dates	Fresno (Calif.) State College
Improvement of grapes and grape products from Washington	Washington State Univ., Prosser, Wash.
New food products from apricots	California Apricot Advisory Board
Commercial evaluation of sub-atmospheric steam scalding of poultry	Foster Farms, Livingston, Calif.

## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Evaluation of improved egg pasteurization process	Pacific Growers (Nulaid), San Leandro, Calif.
Glutaraldehyde tanning of opossum skins, the fur of which is ideal for maintaining proper textile fiber tension in the shuttles of looms	Bucks County Fur Products Co., Quakertown, Pa.
Glutaraldehyde-tanned leather approved for pilots' gloves	Surgeon General's Office (Air Force)
Twin-cattle nutritional study of the effect of high vs. low energy dietary levels on hide structure	University of Wisconsin
Evaluation of new forms of comminuted hide collagen as a binder in human and pet foods	General Mills, Inc., Quaker Oats Co., Princeton Biomedix Laboratories, and General Foods Corp.
Methods of using hide collagen as binder for catfish and shrimp feed pellets	Skidaway Institute of Oceanography, Savannah, Ga.
Glutaraldehyde-treated leather for professional hockey gloves	Union Carbide Co.,
Use of hide collagen preparations in medical applications	FMC Corp. Research Center, Princeton, N. J.
Adaption of USDA equipment and process innovations in milk drying to the drying of citrus juices	A. E. Staley Co. and Gulf Machinery Co.
Manufacture of new foam-spray dried dairy products (whey products and cake mixes)	Kraftco, Pillsbury, and Swift Companies; Land O' Lakes Cooperative

## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Fortification of evaporated milk with iron	Pet, Inc., and Carnation Co.
Pilot plant study to demonstrate whether cottage cheese whey can be dried on an economical commercial scale	Environmental Protection Agency, Delaval Separator Company, Dairy Research and Development Co.
Development of MOD (milk-orange juice drink)	Dairy Development, Inc. (an R & D organization supported by North-eastern states dairy cooperatives)
Evaluation of iron-fortified whole milk	Capital Milk Producers Cooperative, Inc., Frederick, Md.
Alleviation of pollution due to potato starch factory wastes	National Starch & Chemical Corp.
Potential use of added potato protein in extruded deep-fat fried frozen potato products	Western Farmers Cooperative, Idaho Falls, Idaho and Chef-Reddy Foods Corp., Othello, Wash.
Evaluation of Eastern Shore (Va.) potatoes for processing	Virginia State Dept. of Agriculture, Conquest Farms, and Virginia Truck Crops Experiment Station at Painter
Procedures for explosion-puff dehydration of onions to give a rapidly rehydrating piece having desirable flavor qualities	Gilroy Foods, Inc., Gilroy, Calif.
Analysis of some 10,000 corn samples per year for amylose content to guide geneticists in developing high-amylose corn for industrial use.	Bear Hybrid Corn Co.

## III. COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Utilization of linseed oil in protective coatings	Natl. Flaxseed Processors Assn.
Investigations of the development of superior plant sources of vegetable oils of high-erucic acid content	Oregon Agricultural Exp. Sta.
Separation of chopped <u>T. vogelii</u> plants into leaf and stem fractions to improve rotenoid yield	Bauer Bros. Company
Studies of the involvement of <u>Fusarium tricinctum</u> in fescue foot	Agricultural Exp. Stations of the University of Wisconsin and University of Missouri
Utilization of linseed oil for concrete protection	National Flaxseed Processors Assn., and several state highway departments
Iron fortification of corn grits	Spencer Kellogg Division of Textron, Inc.
Green kenaf for processing studies	Indiana Agricultural Exp. Sta. and French Oil Mill Machinery Co.
Utilizing crambé seed meal in lamb feeding tests	University of California at Davis
Investigations of chemical and physiological properties of the alkaloid perfoline found in fescue	Kentucky Agr. Exp. Sta.
State-Federal cooperation on problems of interest to agriculture, forestry, and rural people in the State of Louisiana	Southern University College of Agriculture

## III. COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Cationic aminoethyl yellow corn flour	Illinois Cereal Mills, Inc.
Development of new fiber crops	Several paper companies, including Crown Zellerbach, Weyerhaeuser, and Hudson Paper
Development and production of crambe seed and oil	Purdue University, University of Illinois, Vincennes University, and Southern Indiana Agricultural Improvement Assn.
Processing and evaluation of pale, soft, exudative pork	Department of Animal Sci.. Univ of Ga.
Pollution research--improved methods of blood collection in poultry processing	Central Soya Co., Athens, Ga.
Pollution research--trace element analyses	Southeast Water Laboratory, EPA, Athens, Ga.
Performance of biological activity testing on fractions of tobacco smoke and leaf	Roswell Park Memorial Institute, New York Dept. of Health
Evaluation of "Alar" treated peaches for processing	Georgia Agr Exp Station, Griffin, Ga.
Integration of research programs	Botany Dept., Univ. of Ga.
Investigating chemical constituents in Coastal bermudagrass pellets	Coastal Bermudagrass Processors' Assn. Estill, S. C.
Basic studies of the properties of sunflower important to food use	Texas Agr Exp Station College Station, Tex.



#### IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS

##### (A) Planning and Advisory Activities

The USDA program of utilization research on farm commodities is the product of extensive planning that is continually updated. Its administration has been the direct responsibility of a deputy administrator of the Agricultural Research Service, his supporting staff, and the directors of the five regional research laboratories. A Program Development Staff of ARS, composed of economic specialists has assisted this administrative group in evaluating the appropriateness and commercial feasibility of proposed and existing utilization research projects. Information and guidance are sought from various other sources both within and outside the Department. Among the advisory groups that oversee the program, the following may be mentioned:

Agricultural Research Policy Advisory Committee. This committee, established in 1969, has for co-chairmen USDA's Director of Science and Education and the president of a land-grant college or university. USDA representatives include the administrators of the Agricultural Research Service, Cooperative State Research Service, Economic Research Service, Farmer Cooperative Service, and Statistical Reporting Service, and the deputy chief for research of the Forest Service. State representatives include an Agricultural Experiment Station director from each of four agricultural regions, and representatives of the National Association of State Universities and Land-Grant Colleges, the Association of State College and University Forestry Research Organizations, and the Experiment Station Committee on Organization and Policy.

The objectives of this committee are:

- (A) To develop recommendations for policy with respect to planning, evaluating, coordinating and supporting unified long-range agricultural research programs and delineating the appropriate areas of responsibility of Federal and State agencies in carrying out these programs. The term "agricultural" is used in the broadest sense, including forestry, other renewable natural resources, and rural life.
- (B) To develop further the bases for State and Federal cooperation in planning and implementing regional and interstate research programs. This will include cooperation among Federal agencies, among the State stations, and between Federal agencies and State stations.

#### IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

##### (A) Planning and Advisory Activities (contd.)

National Agricultural Research Advisory Committee. An 11-member advisory committee, with broad national interests in all phases of agriculture, evaluates the Department's research program and offers suggestions, particularly on policy matters, for changes in the program. Four of the committee members are representatives of producers or producer organizations.

Agricultural Associations and Industry Groups. Advice is sought from, and information is exchanged with, all segments of the agricultural industry, including growers, shippers, processors, and distributors, concerning the many problems involved in the profitable development of new or improved uses for agricultural commodities.

Consumer Interests. Information on consumer desires for new or improved products, and on evaluation of such products, is sought through contacts with consumer groups of national and regional scope. Other USDA groups--the Economic Research Service, the Federal Extension Service, and the ARS marketing and consumer use research groups--provide advice on consumer needs and market trends.

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection

The utilization research program is continually reviewed to assess its fruitfulness. Investigations that have reached their objectives are discontinued. Investigations that have passed the point of maximum returns, or are otherwise relatively unproductive, also are discontinued so that the resources may be more effectively applied to new programs. More promising investigations are established or intensified, either by reduction of effort on projects of lesser importance or by use of such new resources as may become available. Examples of the redirection of research effort are shown below:

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
<u>Cereal and Forage Crops</u>	
Conditioning rice kernels to increase milling yields	Rice characteristics which contribute to increased commercial milling yields
Relation of wheat type and constit- uents to baking quality of flours	Effects of sprouting damage on quality of wheat flour and other products
Development of improved frozen unbaked bread products	Development of stable starter cultures for sour dough baked goods
Enhancing bread flavor by improved fermentation processes	Fortification to improve nutritional quality of wheat products
Improved dehydrated feed products from forages	Improved dehydration processes to eliminate air pollution
Production of microbial spores for control of Japanese beetles	Microbial protein from liquid feedlot waste
Properties of proteins of grain sorghum	Protein-enriched feed from feedlot waste



## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Research on high-amylose starch and on photochemistry of amino acids	Enzymatic and photochemical conversion of feedlot wastes to feed or fertilizer
Starch-derived chemicals as replace- ments for phosphate in detergents	Biodegradable surfactants and emulsifiers from corn starch
Polyurethane plastics containing starch	Biodegradable and fire-retardant plastics containing starch
Studies on lipids in artificially dried corn	Nutrients in heated corn food products
<u>Cotton, Wool, and Other Fibers</u>	
Textile products using low and high micronaire cottons	Fiber properties and textile processing techniques for improved cotton/ synthetic blends
Electrostatic alignment of airborne cotton fibers	Apparatus for separating, blending, and individualizing cotton fibers
Weather resistance by zirconium- organometallic finishes on cotton fabrics	Mineral dye and biocide systems for cotton textiles using zirconium complexes
Improved cotton fabrics for durable- press work trousers	Improved processing efficiency and yarn properties by chemical treatment of cotton fiber
Improved durable-press cotton fabric with increased service life.	Improved finishes for knitted fabrics of cotton and low-level blends
Changes in fine structure of cotton during growth in controlled environments	Accessibility and swellability of modified cottons in relation to durable press

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Durable and semidurable flame retardants for cotton	Improved cotton flame retardants based on new or available phosphorus and halogen compounds
	Flame retardants for cotton based on phosphorus-containing linear polym polymers or metal complexes
	Flame-retardant cotton textile finishes based on tris (hydroxymethyl) phosphine
Treatment of cotton with fluorine compounds for better antisoiling properties	Improved cotton textiles with durable oil repellency and soil-release properties
Accessibility of the fibrillar and molecular structures of cotton	Durable-press fabrics through optimum crosslink network development in cotton
Attachment of textile finishing agents to cotton as crosslinked polymer films	Formation of resilient network polymers in cotton with minimal cellulose crosslinking
Reactions in cotton adaptable to delayed-cure crosslinking requiring no external catalyst	Built-in acidic catalysts for delayed- cure finishing of cotton textiles
Improved preliminary treatment techniques for durable-press cotton: fabrics	Yarn mercerization for increased wear life and shape retention in knit cottons
Improved cotton durable press by use of bulking and crosslinking agents	Finishes for lightweight textiles of cotton blended with low levels of polyester fibers

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Controlled polymeric deposition and crosslinking to produce improved cotton textiles	Durable flame- and weather-resistant lightweight fabrics for outdoor recreational uses
Sorption state of water and other cellulose reactants on cotton	Effects of chemical and physical environment on proton mobilities in cotton celluloses
Thermal investigation of reversible crosslinks in cotton cellulose	Heat-sensitive reversible crosslinks in cotton and cotton-polyester blend fabrics
Cotton fiber behavior in electrostatic fields	New method and apparatus for drafting cotton fibers in textile processing
Improved wool and mohair products by interfacially applied resins (reduced effort)	New chemically reactive treatments for modifying wool and mohair
<u>Fruits and Vegetables</u>	
Role of carotene in color and flavor deterioration in dehydrated vegetables	Interaction of carotene and other compounds in autoxidation of dehydrated foods
Bitter constituents of citrus; stabilization of lemon oil	Preparation of biologically active materials from citrus and other plants
Improved nonfermented grape products	Evaluation of raisins from mechanically harvested grapes
Recovery of useful materials from potato wastes (decreased effort)	Characterization and improved determination of potato glycoalkaloids

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Dehydration, especially by explosion puffing, of fruit and vegetable products (decreased effort)	Develop engineering design criteria for experimental equipment for dewaxing fruits and vegetables
<u>Oilseeds</u>	
Chemical, biochemical, and physico- chemical properties of peanut protein	Properties of peanut proteins that may affect use in food and beverage products
Effect of processing on lipid-protein interrelation in peanuts	Effect of lipid-oxidizing systems on shelf life of peanut products
Evaluation of fatty amides from cottonseed oil as lubricants and for other uses	Lubricants and lubricant additives derived from cottonseed oil
Structure and properties of cotton- seed fatty acid derivatives from spectral data	Molecular structure and spectral data for selected cottonseed fatty acid derivatives
Sugar and other polyol esters of cottonseed fatty acids by lower cost processes	Cottonseed fatty acid esters of sucrose and glycosides having food- use potential
Thermal and oxidative stability of safflower oil	New uses for western oilseed (sesame, safflower, castor) in food products
Nitrogen and sulfur-containing polymers from linseed oil	Linseed-oil-derived vinyl polymers for coatings
Selective hydrogenation of soybean oil	Biological discrimination among unsaturated fatty acids Computer control of soybean oil processing



## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	:	New or Expanded Lines of Research to Replace Previous Activity
<hr/>		
New and Special Plants		
Application of photochemical reactions to pine gum, terpenes, and resin acids	: : :	Flame-resistant naval stores deriva- tives for adhesives and related uses
Elevated temperature rearrangements of gum rosin to give new products	: : :	High-temperature reactions of rosin to yield products having industrial potential
Polybasic acids from rosin useful in preparing condensation polymers	: : :	Preparation of rosin dimer acids as industrial raw materials
Concentration of maple sap by reverse osmosis	: : :	Preservation of maple sap and sirup; sanitation procedures for maple industry
Isolation and identification of maple flavor components	: : :	Use of gas chromatographic "profiles" for evaluating processing
Nitrogenous components of cruciferous: seed meals	: : :	Antinutritional factors affecting feed-use of cruciferous seed meals
Poultry, Dairy, and:Other Animal Products		
Physical and chemical properties of poorly characterized egg proteins	: : :	Effects of processing and storage on functional properties of egg proteins
Cheese whey-plant protein blends	: : :	Food uses of high protein fractions of cheese whey
Concentration of cheese whey by reverse osmosis	: : :	Separation of high protein fractions of cheese whey

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Flavor stability of sterilized milks	Fortification of milk and milk products with polyunsaturated fats
Composition of milk proteins	Iron-protein complexes for enrichment of milk
Properties of milk protein	Enzymatic hydrolysis of lactose
Chemistry of bacterial spores	Acceleration of ripening process in cheese making
Assay methods for milk allergens	Antigens of milk and whey
Synthesis of detergents and surfactants	Phosphate free, biodegradable detergent formulations; evaluation of fat based lime soap dispersing agents
Incorporation of animal fat derivatives into polymers	Graft modification of polymers plasticized by fat derived monomers
Chemical modification of hides with reactive dyes	Leathers with improved wear and maintenance characteristics
Chemical modification of hide proteins for improved leathers	Improved methods of preserving animal hides to reduce tannery wastes

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(C) Status of Research ProjectsSummary of Actions

	: Active at :	Initiated :		: Active :
	: beginning :	or :	Terminated :	at end :
	: FY 1971 :	revised :		: FY 1971 :
	:	:	:	:
Domestic	: 392 :	115 :	136 :	371* :
Foreign (P.L. 480)	: 65 :	15 :	21 :	59 :
Total	: 457 :	130 :	157 :	430 :
	:	:	:	:

\*Includes 28 domestic contract and grant projects and one project supported by industry.

Commodity Classification of New Research Projects  
Undertaken in FY 1971

	: Domestic :	Foreign :	Total :
	:	:	:
Cereal and forage crops	: 19 :	4 :	23 :
Cotton, wool, and other fibers	: 28 :	4 :	32 :
Fruits and vegetables	: 9 :	0 :	9 :
Oilseeds	: 21 :	5 :	26 :
New and special plants	: 19 :	1 :	20 :
Poultry, dairy, and other animal products	: 19 :	1 :	20 :
Total	: 115 :	15 :	130 :
	:	:	:

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(D) New or Expanded Research Initiated with Appropriation Increases in FY 1971

Improved cotton and cotton-synthetic blend knit fabric structures (\$110,000).

Removal or utilization of cottonseed whey constituents (\$200,000)

Processes for improved feeds from forage wastes (\$110,000).

Improving the stability of meat products with emphasis on the safety of nitrites and/or nitrates in cured meats (\$165,000).

Development of starch-derived chemicals as reinforcing agents for rubber (\$180,000). (Expansion of existing in-house program)

Increasing the digestibility and nutritive value of peanut hulls for ruminant feeding (\$100,000).

Characteristics of Southern feedstuffs as related to processing and product quality (\$230,000).

Evaluate use of defatted sunflower meal in animal feeds (\$90,000).

Microbial contamination (primarily Salmonella) of poultry and poultry products (\$75,000).

Waste management during poultry processing, including product development of inedible waste (\$110,000).



## V CURRENT UTILIZATION RESEARCH PROGRAM

USDA's utilization research program is directed to finding new or improved uses and improved processing methods for agricultural commodities through basic, applied, and development research. As previously indicated, it is subject to continual review and appraisal at all levels, from Work Units (limited assignments involving up to several man-years of effort for periods of not more than five years) up through broad general areas of activity. Within the general framework of new uses, and in response to recommendations of advisory groups, special attention in recent years has been given to safety of food and feed products as concerns natural toxins, chemical additives, and inadvertent contaminants; to development of products specifically suited to export markets; and to development of modifications in the processing of agricultural commodities that will minimize air and water pollution problems.

The following listing of subject fields will illustrate the general nature of the current program. These are fairly broad areas, some of which have been mentioned in previous reports, while others are new.

### Cereal and Forage Crops

Emphasis is placed on development of new uses for corn and wheat, with concurrent effort on rice, barley, oats, sorghum, and alfalfa and other legumes and grass forages.

New and improved food products--Improved physical properties of wheat doughs; improved quality of frozen unbaked bread; new practical procedures for increasing rice milling yields; new and improved rice products with better nutritive value and other quality factors; new products from rice hulls; improved maturation of wheat flours; new and improved high protein wheat food for export; improved baking performance of blended spring and winter wheats; recovery of food protein from leaf meal; processes to fortify bread and cereal products with nutrient iron.

Nutrients in corn and corn-based foods; dry milling of artificially dried and high-lysine corn; corn and grain sorghum endosperm products for foods; carbohydrates in corn sugar sirups; new methods for milling and fractionation of wheat and wheat flour.

Improved feeds--Improving the nutritive value of alfalfa, wheat, small grains, and mill fractions for ruminant, poultry, and swine feeds; dense, stable, concentrated low-fiber forage products for export; separate recovery of protein and other feed nutrients from forages; improvement of feed values of mill byproducts, straws, hulls, and other agricultural wastes. Mold toxins

## V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

in grain and tall fescue. Development of new and improved processing techniques for Southern feedstuffs to supply economical animal feeds of greater palatability, intake, and digestibility for the production of lower cost livestock and poultry in the region.

New industrial uses--Starch-derived chemicals for use as reinforcing agents in rubber; starch products for use in paper manufacture; microbial gums; fermentative production of L-asparaginase, a therapeutic factor active against leukemias; starch graft copolymers as flocculating, viscosity-improver, and adhesive agents; insecticidal products from microorganisms; conversion of animal wastes to feeds, fertilizers, and industrial products; biodegradable surfactants from starch; industrial products from cereal processing wastes.

### Cotton, Wool, and Other Fibers

Cotton chemical processing--Improved durable-press cotton fabrics; cotton products with improved soil resistance, launderability, and drying characteristics; cotton products with greater resistance to mildew, rot, and air pollution; flame-retardant cotton products with other desirable properties; finishing processes for cotton and cotton blend fabrics; chemical finishing of knitted cotton fabrics for household and apparel textiles; reduction of stream and air pollution resulting from the processing of cotton textile materials.

Cotton mechanical processing--Improved spinning efficiency and yarn quality; improved prespinning processes; aerodynamic-electrostatic-ultrasonic continuous spinning system; improved utilization of discount cottons; improved yarn and fabric structures for knit products.

Improved wool and mohair products--Improved wool and mohair yarns and fabrics requiring minimum upkeep by treatments that impart shrinkage control, permanent creases, wrinkle resistance, soil resistance and release, flame proofing, insect resistance, etc.; improved fabrics from wool and mohair blends; new processes to reduce polluting liquid wastes in processing and treating wool and wool products.

Textiles and clothing--Selection and care of textiles and clothing by the consumer.

### Fruits and Vegetables

Emphasis is given to development of convenience-in-use fruit and vegetable products, and processing equipment for their economic manufacture. The work includes fundamental investigations of factors affecting color, texture, and flavor.

## V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Citrus and subtropical fruits--Citrus products with improved flavor, color, and stability; sweetening agents from citrus flavonoids; improved stability and flavor of nonfrozen subtropical fruit juice concentrates and purees; improving quality and efficiency of processing dates. Improved Texas citrus products; comminuted Southern citrus fruit.

Deciduous fruits and berries--Improved quality and reduced processing costs for fruit products; evaluation of processing characteristics of Pacific Northwest berries and other fruit; improved piece-form and powdered dehydrated fruit products; dried fruit and tree nut products for foreign markets; frozen fruit products with improved texture; improved processes for wine production; control of pollution and conversion of waste products of fruit processing; reduced microbial contamination in processing of fruits; natural product antimicrobials for dried fruit preservation; development of new methods to utilize enzymes in food processing.

Quality products from mechanically harvested cherries and apples; dewaxing and electronic sorting applied to fruit processing; development of continuous processing technology for producing rapidly rehydratable, quick cooking fruit products.

Nondestructive, high-speed, automated quality separation of fruit, including color sorting.

Vegetables--Frozen vegetables with improved texture; dehydrated vegetables of improved quality and stability for export markets; evaluation of processing characteristics of Pacific Northwest vegetables; control of consistency of tomato products; convenience foods and foods with improved nutrient quality from dry beans and peas; canned low-acid foods of improved quality and safety; control of pollution and conversion of waste products from the processing of potatoes and other vegetables; reduced microbial contamination in vegetable processing; effects of processing on folic acid and other nutrients and antinutrients in vegetable products; processes to remove undesirable or toxic components naturally occurring in vegetables and vegetable products.

Effect of source factors on processed potato products; characterization and improved determination of potato glycoalkaloids; improvement of flavor and stability of potato flakes; relationship of chemical and physical properties of fresh potatoes to processing frozen French-fried potatoes; development of continuous processing technology for producing rapidly rehydratable, quick-cooking dehydrated vegetable products; recovery of protein and other useful materials from potato processing wastes.



## V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Modified and enriched products from sweetpotato puree and flakes; improved tomato and other Southern vegetable products.

Nondestructive, high-speed, automated quality separation of vegetables.

### Oilseeds

Food uses--Elimination of the physiological effects of cyclopropenes to safeguard foods containing cottonseed oil; processes for making new food-grade esters from cottonseed oil fatty acids; confectionery fats and other edible sharp-melting fats from cottonseed oil; edible high-protein cottonseed products; environmental contamination of foods; detection, estimation, prevention, and elimination of mycotoxins in cottonseed and peanuts; new and improved peanut products of improved flavor and stability; high-protein peanut products for export and domestic markets.

Improvement of stability of edible soybean oil to heat and storage; development of high-protein soybean food products from export markets; removal of objectionable flavors and other undesirable factors from soybean protein products; process for refining soybean oil at lower cost and with reduced water pollution.

Improved thermal and oxidative stability of safflower oils; new and improved food products from safflower, sesame, and other western oilseed meals; castor oil derivatives with possible use as emulsifiers and texture controlling of food additives.

Determination of the suitability of partially hydrogenated sunflower oil for potato chip frying; chemical analyses of the frying oils and the chips.

Feed uses--Improved animal feedstuffs from safflower, sesame, and other western oilseed meals; production of safe-to-handle nutritious feedstuffs from castor bean meal.

Environmental contamination of feeds; microbial contamination of cottonseed meal products.

Industrial uses--Sperm oil replacements from soybean, linseed, crambe, and other seed oils; nylon-type plastics from soybean and crambe oils; linseed oil coatings for improving low-grade concrete aggregate; improved linseed oil paints. Use of Western seed oils in urethane foams, elastomers, etc.

Functional fluids and other industrial products from cottonseed oil.

## V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

New and Special Plants

Investigations to develop new and more economic uses for special domestic plants and their products; and to develop compositional data on plants from world-wide sources, to find alternate crops to fill needs not now met by domestic sources.

Naval stores products--Condensation polymers from rosin derivatives; new and improved derivatives from rosin for use in adhesives and concrete.

Tobacco--Studies of physiologically-active compounds in tobacco leaf and smoke; determination of products formed on burning leaf tobacco; effect of added chemicals on smoke composition; development of rapid bioassay methods and measurement of tobacco smoke condensate by these methods.

New alternate crops--Uncultivated plants as sources of new industrial oilseeds; papermaking pulp from kenaf; anti-tumor drugs from plant sources; special-purpose plasticizers and new allylic resins from high-erucic and other new seed oils.

Other crops--Practical methods for the recovery of sugar from sweet sorghum; improved yield and purity of refined cane sugars; development of new and improved preservative methods for maple sap and sirup; better sanitation procedures for maple industry; development of a model maple sap processing facility for rural areas.

Poultry, Dairy, and Other Animal Products

Development of better and more economical food products from poultry, eggs, milk, and meat, and development of new outlets for fats, hides, and other animal byproducts.

Poultry and eggs--Low-cost, uniform aging of turkey for freezing; process modifications to improve and extend the variety of turkey products; elimination of processing damage to egg products; control of salmonella in poultry meat, liquid eggs, and dried eggs; processes to improve the aroma and flavor of cooked poultry; improved feather removal practices to reduce contamination of product, accumulation of polluting liquid wastes and toughness of products.

Improved flavor and texture of broiler products through processing modifications; reduction of pollution from poultry processing wastes by new procedures that will utilize greater percentages of the carcasses, minimize



## V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

the volume of processing waters, and convert the processing wastes to profitable uses or disposal without pollution hazards; improved plant procedures to minimize contamination of further processed poultry products by microorganisms that affect the quality and wholesomeness of the products.

Dairy products--Control of pathogenic microbial contamination in dairy products; development of methods for accelerating cheese ripening; enrichment of dairy products with iron and polyunsaturated fat; improved efficiency and lower cost of whey disposal; studies to eliminate the development of off-flavor in sterile milks during storage; studies to identify and inactivate milk allergens; characterization and utilization of flavor potential of milk fat; new feed and food uses for whey.

Animal fats--Plastics, resins, and plasticizers from animal fats; new biodegradable detergents from animal fats; replacement of phosphates in detergent formulations; lubricant components from animal fats; development of reactive chemical intermediates from fatty acids for industrial use.

Meat products--Control of microbial contamination of meat and meat products through improved processing techniques; development of rapid analyses for process and product control; improving functional, organoleptic and nutritional values of processed meats; development of improved processing methods for increased stability in meat and meat products; studies on chemical residues in meat resulting from processing.

Improved technology for processing dry fermented sausages; improved procedures for processing pale, soft, exudative (PSE) pork to lessen shrinkage, maintain quality, and expand use in processed pork products.

Hides and leather--Chemical modification of leather for easier maintenance, and improved wear resistance; lower cost leather manufacturing for industry, including continuous processing; expanded use of collagen in foods, feeds, and industrial products; control of environmental pollution in processing hides and manufacturing leathers.

## VI FINANCIAL INFORMATION

The F.Y. 1971 Obligations and F.Y. 1972 Estimated domestic utilization research and development funds under "Agricultural Research Service," including allocation from the Special Fund for additional labor, are as follows:

	F.Y. 1971 Obligations	F.Y. 1972 Estimated
Cereal and forage crops . . . . .	\$8,598,534	\$9,131,700
Cotton, wool and other fibers . . . . .	7,288,831	7,993,700
Fruits and vegetables . . . . .	6,259,792	6,529,500
Oilseeds . . . . .	5,542,067	5,449,600
New and special plants. . . . .	3,088,391	3,563,000
Poultry, dairy, and other animal products. . . . .	8,331,242	8,675,900
	<u>\$39,108,857</u> a/	<u>\$41,343,400</u> b/

a/ In addition to the 1971 total shown above, the following was obligated under nonrecurring allocation from the Contingency Research Fund:

- \$43,998 for extended studies on the effect of Southern corn leaf blight damage on the physical and chemical characteristics of corn.
- \$50,000 for purchase of data reduction equipment for mass spectrometer used in the analysis of food products to determine potential content of toxic nitrosamines.
- \$17,664 for a research contract with the University of Nebraska on pasteurizing meat with low dose radiation.
- \$60,000 for a pilot plant processing line for evaluating processing quality of clingstone and freestone peaches on a commercial basis.

b/ Includes \$807,000 proposed supplement to meet the 1972 increased pay costs authorized by Executive Order 11637 issued pursuant to the Federal Employees Salary Act of 1972 (P.L. 92-210) and wage board costs.

#### Supplemental Information

(A) In addition to the domestic program, the equivalent of approximately \$524,700 in foreign currencies was obligated in Fiscal Year 1971 for utilization research projects (largely extending over a five-year period) conducted under agreements with foreign institutions. This work is financed by funds generated under the Special Foreign Currenty Program.

(B) The Fiscal Year 1972 Appropriation Act provided an increase of \$65,000 for research to reduce losses from Southern corn leaf blight and to determine the nature of host-parasite relationships in crop plants at Peoria, Ill.

## VII SELECTED RESEARCH ACCOMPLISHMENTS

Examples of the current program of utilization research were given in Section V of this report. In the present section are presented 19 selected examples of recent accomplishment under this program. For the most part, these examples concern research that has proceeded through the applied and developmental stages to the point of commercial acceptance of the processes or products involved. The accomplishments are illustrated on the facing pages.

### Versatile food blend for foreign programs

Department scientists have developed processing technology for making an instant cereal food blend which, when prepared by users, provides either a highly nutritious food drink or a gruel or porridge with high caloric density. The blend, which includes corn, soy flour, nonfat dry milk, minerals, and vitamins, maintains the composition of regular CSM (corn-soya-milk). The key step in the new process is treating the cereal component of the blend in extruders in such a manner that the starchy portion of the cereal is fully cooked and has low viscosity and high solubility properties. Other cereals such as sorghum, rice, or millet, or a tuberous starch such as cassava, can be used in place of corn. Other ingredients like sugar, salt, flavorings, or spices can be added to the basic blend to suit the taste of the user.

Wide usage of the food blend can be expected, for it may be used as a supplement to breast feeding; as a weaning food; or as a regular diet for all young children after weaning. In addition, the food blend can fill a need for supplying older children and adults with a nutritious beverage or porridge base.

The Department is purchasing multi-ton quantities of a gruel version of this versatile corn-soya-milk food blend for distribution in its foreign emergency programs. The product also has good potential for domestic usage.



# ***USDA Scientists develop processing technology for making high-caloric instant cereal food blend***

- provides highly nutritious food drink, gruel or porridge
- blend includes corn, soy flour, non-fat dry milk, minerals, vitamins
- ideal weaning food, or for older children



- U.S.D.A. helps feed the hungry of the world through its foreign emergency food programs
- 4+ billion helpings served to people in over 90 countries

Lysine-fortified bulgur for overseas markets

Bulgur has advantages in overseas markets and particularly in food aid programs. These advantages stem from widespread familiarity with wheat as a basic food and the relative blandness, low fiber content, and resistance to insect attack after processing into bulgur. The low lysine content of wheat, however, limits the nutritional value of the protein. If other protein is not available to balance the amino acid composition, much of the potential value of the wheat protein is not realized.

The feasibility of infusing lysine hydrochloride into wheat during the production of otherwise normal bulgur was shown in work by scientists. Because the protein quality is markedly improved by addition of only 0.1 percent lysine, this procedure offers a direct and inexpensive way to enhance the nutritional value of bulgur. Specifications for a rinse-resistant, lysine fortified bulgur were prepared. Reliable analytical procedures were developed to monitor the process and to inspect commercially prepared lots to insure the proper amounts of lysine had been added.

Over 7 million pounds of lysine-fortified bulgur were used to help alleviate hunger and malnutrition in Nigeria in 1969 and 1970. Recent purchases have been even larger, amounting to 10.5 million pounds contracted in July 1971.



*USDA scientists develop:*  
**LYSINE-FORTIFIED BULGUR WITH  
INCREASED NUTRITIONAL  
VALUE FOR OVERSEAS  
FOOD AID PROGRAMS**



**cheap, stable, basic wheat food for  
overseas and domestic consumption**

***Over 7 million pounds  
distributed in 1969-70***

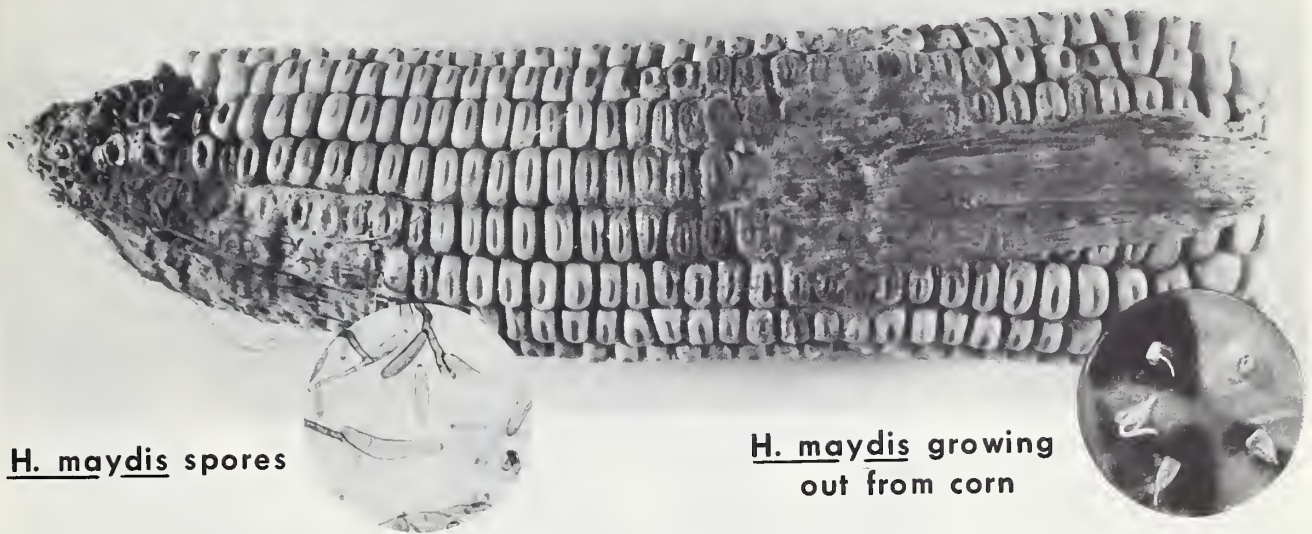
***10.5 million pounds  
contracted for in July 1971***

Quality of milled products from blighted corn remains generally good

Scientists have shown that milled products from corn affected by Southern corn leaf blight retain good quality. Although blighted corn grades lower in quality than uninfected corn, both wet-milled products (starch and oil) and dry-milled products (grits and meal) were generally indistinguishable from similar products milled from uninfected corn. Crude oil from blighted corn contained more than the normal amount of free fatty acid, which, however, could be readily removed during refining. Taste panel tests revealed no flavor or odor problems. The only disadvantage observed with blighted corn was that yields of products decreased as blight damage increased. There was no evidence of a toxicity problem due to the blight itself, providing no subsequent infection with other toxin-producing molds had occurred.

Severe losses were widespread in the corn belt in 1970 because of infection with a new race of Southern corn leaf blight, Helminthosporium maydis Race T. Other than the decreased yields of milled products, blighted corn should be as useful as unblighted corn for commercial purposes.

# SOUTHERN CORN BLIGHT RESEARCH SHOWS NO PROBLEM IN PROCESSING BLIGHTED CORN



H. maydis spores

H. maydis growing  
out from corn

***Evaluated for toxicity and other characteristics related to product quality***

## **RESULTS:**

- product yields decreased as blight damage increased
- products from blighted and normal corn generally indistinguishable - no flavor or odor problems-no toxin-producing molds
- crude oil contained more than normal free fatty acid

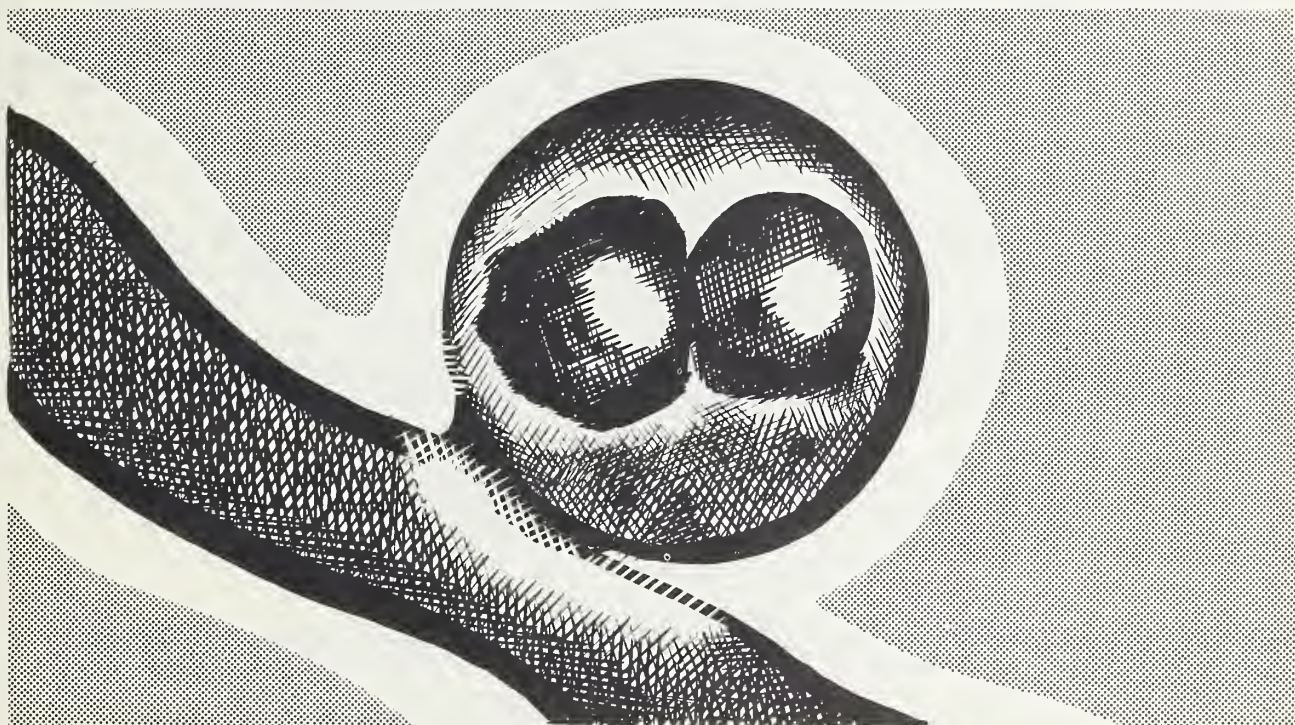


### Breeding yeasts for food and feed protein

Scientists have discovered mating strains of a yeast commonly grown as a source of protein for food and feed. Sexual reproduction was previously unknown for this yeast. Now it should be possible to breed (hybridize) for strains that will produce increased yield of higher quality food and feed protein. Protein deficiency in many countries throughout the world has greatly stimulated interest in using microorganisms as a source of protein for food and feed. Various types of processing wastes, as well as petroleum, are some of the more promising materials on which these microorganisms are grown. Besides producing protein, growth of these microorganisms can, therefore, contribute to reducing pollution by converting wastes to more valuable products. Researchers throughout the world have requested cultures of the new mating strains.

*ARS Scientists discover. . .*

## **BREEDING OF NEW HYBRID YEAST STRAINS PRODUCES INCREASED YIELD**



- **combats world-wide protein deficiency**
- **produces higher quality food and feed protein**
- **reduces pollution by utilizing waste products for growth of microorganisms**



### Alfalfa xanthophylls for poultry rations

The inclusion of approximately one million tons of dehydrated alfalfa meal in poultry rations, both in the United States and overseas, is largely dependent upon the poultry-pigmenting xanthophylls in alfalfa. Scientists, utilizing pilot- and industrial-scale dehydrators, determined the best conditions to preserve xanthophyll during alfalfa dehydration. They found that up to 60 percent of the valuable poultry-pigmenting xanthophylls may be destroyed during conventional dehydration. These losses were correlated with meal moisture and drier outlet temperatures. Vitamin E and the essential amino acid lysine were also found to be lost under adverse drying conditions. The conditions for preserving the xanthophyll and other nutrients have been included in USDA publications which have been distributed to most members of the American Dehydrators Association, at their request. Improved analytical procedures also have been developed to analyze the alfalfa meals for both total and the pigmenting xanthophylls. Scientists have isolated and fed to poultry the principal xanthophylls of alfalfa. They determined that the epoxide-xanthophylls are non-pigmenters for poultry, and developed a procedure which excluded these compounds from analysis. The new analytical method is now in use and forms the basis of pricing alfalfa used for poultry rations. Such developments enable feed formulators to confidently evaluate the xanthophyll content of alfalfa meals and compute least-cost feed formulations.

*Utilizing pilot and industrial-scale dehydrators  
ARS scientists determined best conditions for*

## **HIGHER QUALITY DEHYDRATED ALFALFA FOR POULTRY RATIONS**

### **RESULTS:**

- pigmenting xanthophylls identified
- pigmenting values assured
- dehydrator operations improved to reduce losses of:

**Xanthophylls**

**Lysine**

**Vitamin E**

- better least-cost formulation

Permanent sizing of yarns reduces pollution and improves durable-press cottons

Several textile mills are evaluating a new type of sizing recently developed by scientists. Unlike conventional sizing, which must be washed out after the yarn is woven into fabric, the new sizing is permanent and thus does not enter a mill's waste disposal system as an effluent. Consisting of polymers such as polyurethanes or polyacrylates, it is also attractive to industry because it can be applied from a standard commercial slasher without modification.

In addition to reducing a major source of stream pollution from mills, use of permanent sizing also yields better durable-press cotton textiles. Since cross-linking agents can be incorporated into the formulation at a lower level than that required with conventional sizing, the treated fabrics retain their strength and have excellent abrasion resistance--properties that are requisite to the success of all-cotton durable-press products.

# NEW PERMANENT SIZING OF COTTON YARN DEVELOPED

- Reduces major source of stream pollution from mill waste
- Improved durable-press cottons retain strength and resist abrasion



***TEXTILE MILLS CURRENTLY EVALUATING!***



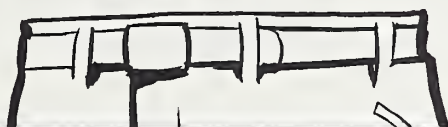
Longer-wearing durable-press cotton work trousers evaluated by industry

Recent research by scientists has greatly improved cotton's competitive position in one of its major markets--trousers for work and similar uses, for which an estimated 609,000 bales were consumed in 1969. To meet the challenge of synthetics, cotton turned to durable press, but crosslinking treatments caused severe losses in fabric strength and abrasion resistance. However, detailed investigations showed that performance can be improved by properly selecting fabric structure for a specific chemical treatment. The all-cotton fabrics that were developed have two to four times the service life of the standard durable-press cotton fabric used for work trousers, and retain very good smooth drying and crease retention characteristics after laundering. In addition, they cost slightly less to produce than plain woven fabric. Impressed by these excellent properties, one of the largest chain stores in the country has evaluated the trousers in its testing laboratories with excellent results. If wear trials now in progress continue to be successful, the chain will be interested in offering these trousers in its 1700 stores.



*to meet the challenge of synthetics. . .*

# **ALL COTTON DURABLE PRESS WORK TROUSERS**



- longer wearing

- smoother drying and better crease retention after laundering

- lower cost than plain woven fabric



Foam-mat dried orange crystals produced commercially in two plants

Having traveled to the moon with the crews of Apollo 14 and 15, orange crystals are now available to earth-bound consumers. A large foam-mat drying plant recently built in Florida is now packing more than half a million 15 and one-half ounce cans of the crystals for the Department of Defense and plans to begin production for the retail trade soon. In addition, a company in Oregon expects to expand production of the crystals in its custom drying plant.

Developed by scientists in cooperation with the Florida Citrus Commission, the procedure is also applicable to grapefruit, other types of citrus, and berries. The crystals readily dissolve in water to yield a fresh-tasting, nutritious juice. Since they are lightweight and do not need refrigeration, they are attractive for export as well as domestic consumption. The potential demand for the product is tremendous, not only for beverages, but also for processed dried foods or other formulations in which the moisture in fresh fruit is a problem.

*U.S.D.A. scientists in cooperation with Florida  
Citrus Commission develop procedure for*

# **COMMERCIAL PRODUCTION OF FOAM-MAT DRIED ORANGE CRYSTALS**



- dissolve in water-yield fresh tasting, nutritious orange juice-applicable to other citrus and berry juices
- large potential demand for processed foods
- lightweight, no refrigeration-good export potential
- Florida plant currently packing over 1/2 million cans for Dept. of Defense
- Oregon plant expanding production on custom basis



### Dry caustic peeling of fruits and vegetables

Scientists have developed new processes for peeling fruits and vegetables which show great promise in reducing the water pollution resulting from processing these commodities. The "dry" caustic peeling process, developed earlier for use on white potatoes, has been modified for use on various fruits and vegetables. The new processes involve a brief treatment with caustic soda, followed by mechanical removal of the peel. The peel material is recovered in a form which can be used for feed, or disposed of by returning to the land. Conventional peeling methods produce high volumes of water waste, with very high blancher effluent strength (BOD).

Different fruits and vegetables require different peeling apparatus and procedures. Pilot-scale trials have been successful on pears, table beets, turnips, apricots, freestone peaches, and chili peppers. A Federal Water Quality Administration grant has been awarded to a North Carolina cannery to test the commercial feasibility of dry caustic peeling of sweetpotatoes. The first commercial scale peeler for fruit, handling 15 tons per hour, started operating on cling peaches in California in 1971. The dry caustic peeling methods offer economic advantages to processors, by permitting pollution abatement at very low cost or even, as in the case with potatoes, at a profit.



## **POLLUTION REDUCED BY DRY CAUSTIC PEELING**

*of freestone peaches, cling peaches,  
pears, apricots, sweet potatoes,  
table beets, turnips, chili peppers*

- mechanical removal of peel eliminates BOD in waste water
- peel waste may be used as animal feed
- economic advantages in pollution control



On-the-farm cherry processing

In the past, cherries have been collected at the orchard and shipped to central packing plants for processing. This practice can result in losses in product quality due to hauling, rehandling, and delays arising from production scheduling at the plant. A team of scientists of different disciplines studied this problem and demonstrated that processing at the orchard site is practical and that the problems associated with such a practice could be overcome. The team prepared specific recommendations for industry on how this could be accomplished. Last season, a number of tart cherry producers in the Michigan cherry-producing region adopted the recommendations, and reported that the new procedure is very successful. Using rented equipment, eight orchard-side plants handled 15 percent of the national crop and achieved a level of product quality not previously attained. As a result, additional gross income of about \$450,000 was realized by these growers. The increase in yield of processed fruit added \$270,000 and the increase in fruit quality contributed \$180,000 to this additional income. The success of this development is now firmly established and is serving as the initial step in reversing the recent trend toward large, centralized cherry processing operations, with resulting benefit to rural communities.

# USDA RESEARCH TEAM RECOMMENDS ON-FARM CHERRY PROCESSING

*Research findings of USDA chemists and engineers can lead to higher yields, consistently better products, and improved return to growers.*



- results in increased income to local communities

Individual quick blanching (IQB) for pollution abatement and improved nutritional quality of canned and frozen vegetables

Blanching of vegetables for canning and freezing is, after peeling, the second greatest source of water pollution in this processing industry. In-plant trials, using a two-stage blanching process (IQB) developed by scientists, show promise for reducing blancher effluent strength (BOD) up to 80 percent of that of conventional methods. Vegetables to be blanched are held on a moving belt in a single layer while exposed for a short time to steam. The pieces are then piled in a deep layer on a second belt passing through an insulated chamber, thus allowing time for the heat absorbed in the steam chamber to penetrate the pieces. The new system greatly reduces the volume of excess water resulting from blanching, which in conventional blanching leaches soluble nutrients from the vegetables. A predrying step, when combined with IQB, results in a process which essentially eliminates all blancher effluent.

Two 300-pound-per-hour continuous pilot blanching lines, operating in a frozen food plant in the northern San Joaquin Valley of California, and in a Wisconsin canning plant, have attracted widespread industrial interest. At least one equipment supplier is considering the manufacture of blanching equipment incorporating the IQB concept.



# 2-STEP INDIVIDUAL QUICK BLANCHING FOR VEGETABLES

- eliminates up to 80% major pollution source
- improves nutritional quality of canned and frozen foods

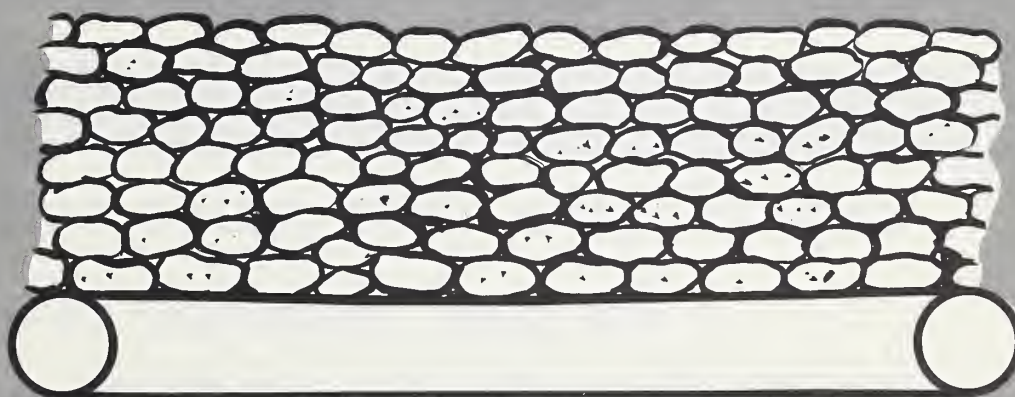
STEAM IN SINGLE LAYER

1



HOLD IN DEEP LAYERS FOR HEAT PENETRATION

2



INDUSTRY EVALUATION UNDERWAY!



Freeze-leaching improves french-fried potatoes

By a new process, extremely variable raw potato material can be used to manufacture frozen or par-fried potato strips. This product has uniform good color and superior textural quality. The process reduces storage losses, eliminates the need for post-storage conditioning at warm temperatures, and makes possible the use of potato varieties not previously suitable for these products. A surface freezing with food grade refrigerant, followed by leaching of solubles from surface cells, eliminates the excessive darkening of french-fried potatoes caused by storage-induced increase in reducing sugars. The surface treatment also restricts the absorption of cooking oil (reducing cost of manufacture and caloric content of products) and protects crispness of products so they do not become limp on the consumer's plate.

The process has been successfully tested in the laboratory and on continuous prototype equipment in commercial food operations. Equipment of two manufacturers has been used, and one of the manufacturers is negotiating to construct full commercial-scale equipment for a major producer of refrigerated, par-fried potatoes. Several producers of frozen french-fried potatoes have sought detailed information in anticipation of introducing this new process as soon as large-scale equipment is successfully operated.

# USDA LABORATORIES DEVELOP NEW FREEZE-LEACHING PROCESS FOR BETTER FRENCH FRIES



**FREEZE  
SURFACE**



**LEACH  
SOLUBLES**



**FRY**

## **EFFICIENT, ECONOMICAL PROCESS**

- **better color, stay crisp longer**
- **fewer calories, less oil**
- **storage losses reduced**
- **conditioning eliminated**
- **more potato varieties usable**

New vegetable and fruit snacks

Several new deep-fat fried vegetable and fruit chip products developed by scientists have now achieved nationwide marketing. The new snack items combine the natural taste of the vegetables with unusual flavor overtones that form during the processing. The chips have excellent keeping quality. In developing these new products, a study indicated that five vegetables could be processed into chip products that had potential for consumer use. Variety and maturity studies were then made for each of these vegetables in order to select the best raw material for processing. Samples of chips were produced under various processing conditions and were evaluated for consumer acceptance, with emphasis on flavor and texture. Optimum conditions were then chosen for the manufacturing of the chips. Later, the work was extended to the processing of apples into chips, and again an acceptable product was developed. At present, chips are being produced commercially from apples, sweetpotatoes, beets, mushrooms, and parsnips. Since only the highest quality raw material is used to produce an acceptable snack food, both the grower and the consumer benefit by this development. An estimate of the retail value of current production is over \$400,000.



# ARS SCIENTISTS DEVELOP NEW VEGETABLE AND FRUIT SNACKS



- delicious natural flavor enhanced by deep-fat French frying
- apple, sweet potato, beet, mushroom, and parsnip chips now available commercially
- retail value of current production now over \$400,000



Commercialization of high-protein cottonseed flour produced by the liquid cyclone process

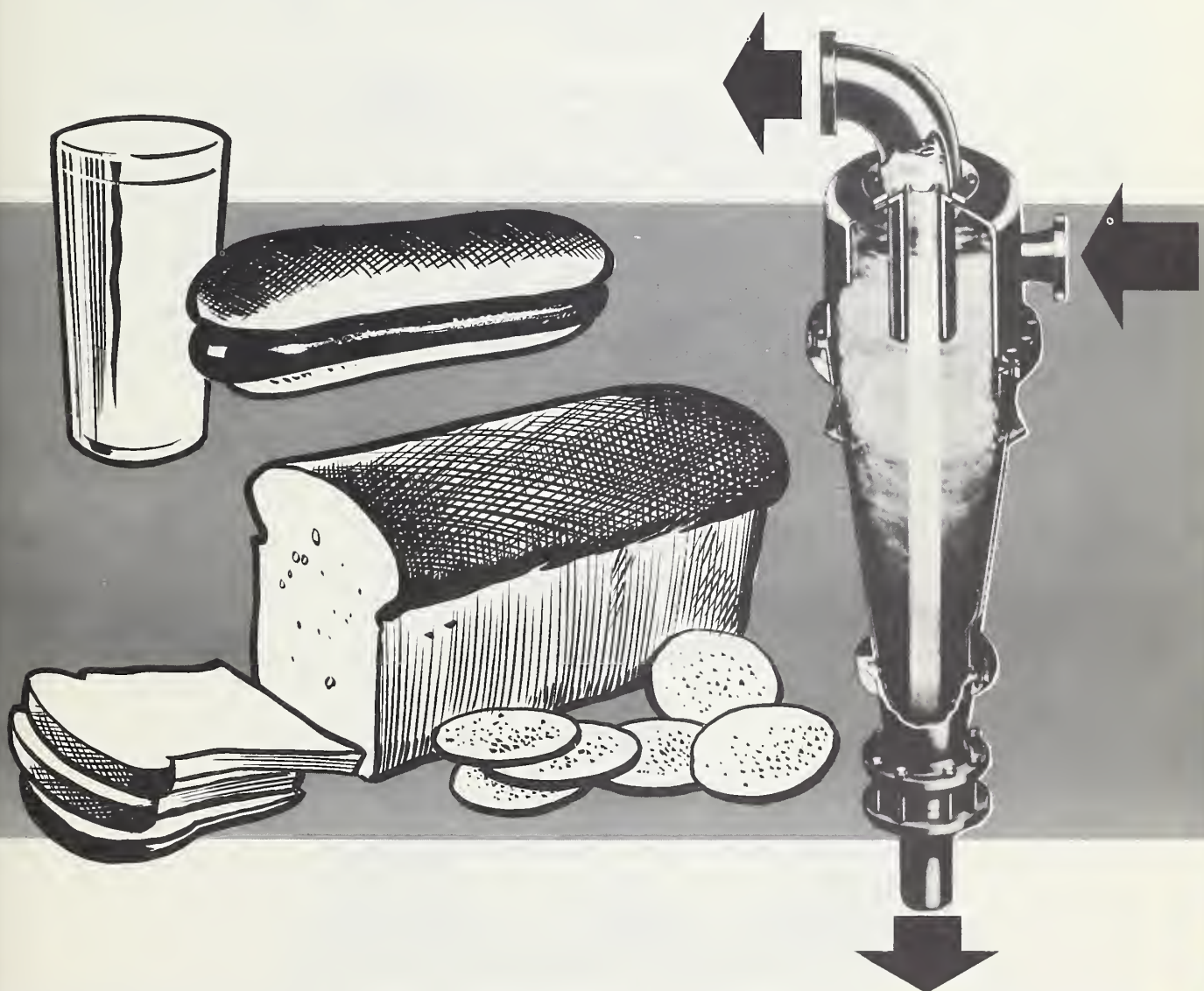
Providing sufficient protein in a form acceptable to a specific population is one of the major problems confronting the world. By utilizing a crop now grown in many countries, the liquid cyclone process developed by scientists is contributing to the solution of this problem, for it provides a method of preparing an edible, high-protein flour from glanded cottonseed. An American company is producing about three tons of the flour a day in India, and a plant that will yield 25 tons a day is being constructed in Texas.

The use of cottonseed for food was previously limited because it contains gossypol, a pigment that may cause physiological effects. But the new process obviates this difficulty: the cyclone separators concentrate most of the protein in one fraction and simultaneously transfer most of the gossypol into the other fraction. The first product, a fine flour that is bland in flavor and light in color, contains as much as 70 percent protein by weight and can be used to make isolates containing 90 percent protein. Major potential markets appear to be in bakery and meat products, textured analogs, and beverages. The other product, a coarse meal, could be mixed with a feed product or used as fertilizer.

Economics of the process are favorable. Whereas most of the domestic cottonseed crop is now restricted to livestock feed, which sells for about 4 cents a pound, the high-protein fraction used for food would cost about 8 to 10 cents to produce and could sell competitively for 15 to 18 cents. Among other attractive features, the process is continuous and much of the equipment required is the same as that now used in hexane extraction plants.

# HIGH-PROTEIN COTTONSEED FLOUR PRODUCED BY LIQUID CYCLONE PROCESS

- for domestic markets
- for developing countries



- enriches bread and other bakery items
- meat products
- beverages

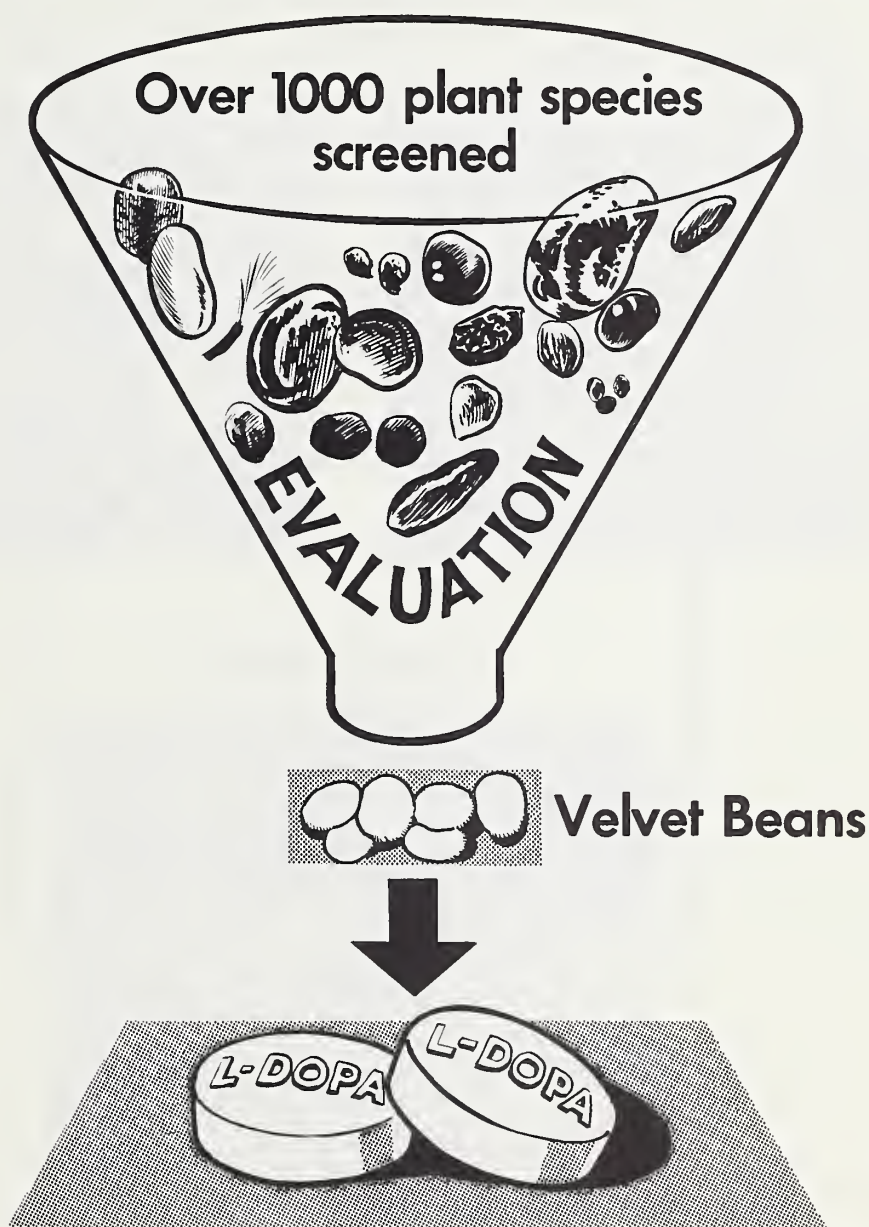
### L-Dopa in seeds

How much and in which species? Research by scientists has answered these questions and developed a method for recovery of virtually all of the L-dopa from the richest sources. This new drug dramatically alleviates symptoms in most cases of Parkinson's disease. Although several companies have received or applied for Food and Drug Administration approval to market it, the best route for commercial production remains moot. Chemical synthesis gives a difficulty-separable mixture of the medically useful L-dopa and the undesirable D-form. A fermentation procedure avoids this problem but requires a relatively expensive starting material. The study has provided valuable information to help interested firms assess the merits of extraction from seeds as a feasible alternative.

Of seeds from more than 1,000 species analyzed, only velvet beans and close relatives contained enough L-dopa to warrant consideration as commercial source. Many seeds reputed to contain the substance, such as broad beans and sesame, actually had only traces of it. On the other hand, the level in velvet beans was near 4.5 percent, or more than twice as much as previously reported, and a few close relatives contained significantly more (up to 10 percent in one sample). Unfortunately, the relatives are at present not well adapted to American agriculture, but velvet beans grown in the United States have produced 1,500 pounds per acre. This yield, coupled with the new recovery method, could afford 60 pounds of the valuable drug per acre.



# U.S.D.A. STUDY DEVELOPS NEW METHOD OF EXTRACTION OF L-DOPA FROM SEED SOURCE OF DRUG FOR PARKINSON'S DISEASE



**NEW RECOVERY METHOD: 60lbs. of drug per acre**



New seed oils as future raw materials

Interdisciplinary research involving close cooperation among botanists, chemists, and agronomists is uncovering prospective new agricultural products having a wide range of useful properties and possible applications. With the primary objective of developing new crops, this project is yielding discoveries of previously unknown seed oil constituents at an average rate approximating one per hundred species of uncultivated plants investigated. So far, it has resulted in over 60 additions to the repertoire of diverse natural chemical entities accessible for technological utilization. Besides the ones containing these substances identified for the first time, other new seed oils have been found to be exceptionally rich sources of already known compounds of economic interest. Fifteen of the new seed oils discovered in the project could serve in current industrial uses, and at least six are known to be receiving some degree of attention by one or more commercial firms. Conceivably more important in the long run, an extensive array of versatile raw materials potentially available from agriculture is being accumulated that will provide valuable insurance against possible future needs to supplement non-renewable chemical resources.

# USDA INTER-DISCIPLINARY RESEARCH SEEKS NEW OILSEED CROPS FOR FUTURE RAW MATERIALS FOR INDUSTRY

## BOTANY



## AGRONOMY



## CHEMISTRY



***Provides valuable insurance against future needs to supplement non-renewable chemical resources***

Milk-orange juice beverage developed

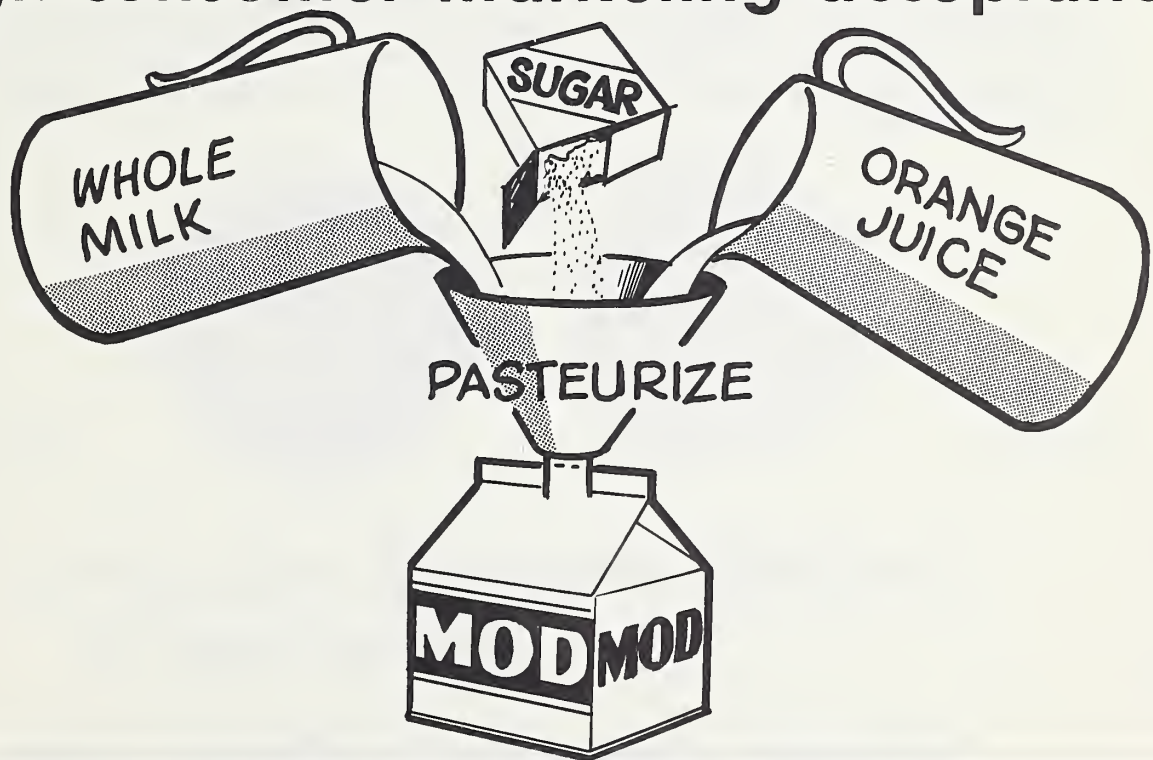
The continuing decline in per capita consumption of whole milk is of considerable concern in relation to the nutritional well-being of the U. S. population, and to the economy of the dairy industry. The development of new milk-containing products with appeal to consumers, including non-milk drinkers, would help halt or reverse the decline. Such a product containing milk and orange juice as the principal ingredients has been developed cooperatively by scientists and Dairy Development, Inc., a nonprofit corporation owned by dairy cooperatives in the Northeast. The preferred formulation of the product, called "MOD" (from Milk Orange juice Drink), contains about 3 parts of whole milk and 2 parts of orange juice plus sufficient sugar for sweetness and a small amount of stabilizer. This formulation gives a stable, flavorful beverage which cannot be obtained by simple admixture of orange juice and milk. The refreshing drink combines the highly desirable protein and mineral constituents of milk with the vitamins and other nutrients of orange juice. The amount of vitamin C in one 8-ounce glass of the beverage supplies all of the recommended daily requirement of that vitamin for children 10 years of age. Tests indicate no significant loss of vitamin C as a result of pasteurization.

The product has been received favorably in consumer tests involving more than 15,000 samples. A market test in one cafeteria showed that 50 percent of the purchasers bought the beverage a second time. The purchases were made at the expense of other non-carbonated beverages rather than milk. The product has been produced satisfactorily on a commercial scale and is now available for marketing as a new dairy product. Successful marketing of the beverage may stimulate interest in related nutritious products containing mixtures of milk and other fruit juices that could be developed.



# DEVELOPMENT OF NEW MILK-CONTAINING PRODUCTS HELPS MEET NUTRITIONAL NEEDS OF U.S. POPULATION

- blends proteins and minerals of milk with vitamins and nutrients of orange juice
- benefits dairy industry... easy processing-utilizes existing equipment
- high consumer-marketing acceptance



MILK+ ORANGE JUICE + SUGAR + STABILIZER



### Phosphate-free detergent formulations

Household and industrial detergents must be formulated so that their subsequent disposal into water systems will not have an adverse effect on the native plant and animal life in these waters. One way that detergents may produce an adverse effect is by stimulating the growth of certain plants, which eventually results in a disturbance of the ecological balance of aquatic life. It is believed by many that the phosphates in detergents act in this way by stimulating the growth of algae; eventually, the excessive algal growth decomposes and, in the process, depletes the oxygen in the water, a process called "eutrophication." Many aquatic plants and animals, including fish, cannot survive in such oxygen-depleted water.

Although detergents without phosphates are currently on the market, many possess serious shortcomings and are not universally acceptable. Scientists are now developing phosphate-less detergents based on soap, which do not have these serious shortcomings. Soap is an excellent detergent but has the disadvantage of producing a curd ("bathtub ring") with water of even moderate hardness. This curd is esthetically undesirable and, during washing, is deposited on clothes giving them a grayish cast. Scientists have found that, by adding certain chemicals derived from animal fats, soap can exert its excellent cleaning power without curd formation. These chemicals are known as "lime soap dispersing agents." In laboratory tests, combinations of soap and lime soap dispersing agents without phosphates can be formulated that give cleaning power excelling the common, highly effective phosphate-containing household detergents even in hard water. These results show the feasibility of developing effective household cleaners that do not contribute to water pollution.

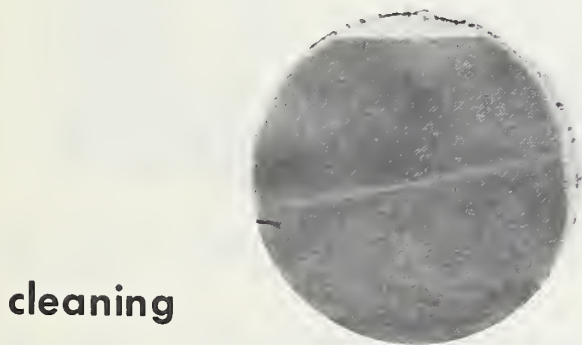
# **ARS SCIENTISTS DEVELOP NEW PHOSPHATE - LESS DETERGENTS SOAP - CURD DISPERSANT**



**With no dispersant  
- heavy curd**



**With dispersant  
- curd dispersed**



**cleaning**



**better  
cleaning**

- **soap plus dispersant effective  
in hard water**
- **has excellent cleaning power**
- **helps eliminate water pollution**

### New process for dry cleanable leather

Garments made from leather are becoming increasingly popular. A major shortcoming of such garments is the lack of an inexpensive method for cleaning them. Ideally, such garments should be capable of being cleaned by common dry cleaning methods without special handling; however, until recently, these cleaning methods altered the properties of the leather, since the solvent leached the fat liquor from the leather and the garments lost their original flexibility and suppleness. To restore these properties it was necessary to reprocess the garments after dry cleaning, which greatly increased the cleaning cost.

Scientists have now developed a way to treat leather so that it can be dry cleaned. During processing of the leather and prior to manufacturing into garments, the leather is treated with a special chemical substance, a long chain amino acid derivative made from coconut oil. This agent acts as a fat liquoring agent which is resistant to dry cleaning solvents. No re-oiling or other processing is needed after the dry cleaning. Samples of suede leather, produced in a commercial tannery using this process, possess a high degree of dry cleanability.

# **NOW... DRY CLEANABLE LEATHER**

*U.S.D.A. scientists develop new chemical process to treat leather for garments*



- no special dry cleaning needed
- no reprocessing
- cuts cost of dry cleaning leather
- solves an important problem in expanding market for leather garments













